PATENT ABSTRACTS OF JAPAN

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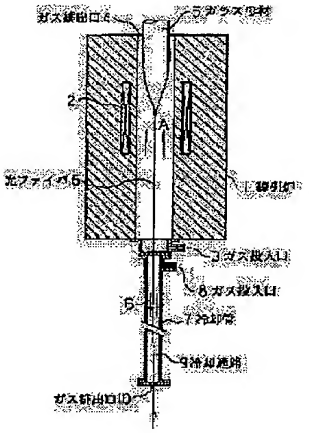
(71)Applicant : HITACHI CABLE LTD
(72)Inventor : OKUBO TAKESHI
KUROSAWA YOSHINORI
OGOSHI MIKIO

(54) METHOD AND DEVICE FOR PRODUCTION OF OPTICAL FIBER

(57)Abstract:
PROBLEM TO BE SOLVED: To inhibit variation in outer diameter of the produced optical fiber from being caused and to prevent reduction in strength and increase in transmission loss, due to formed dust, of the optical fiber from being caused by drawing an optical fiber from a glass preform while supplying gaseous helium into a drawing furnace, and thereafter introducing the optical fiber into gaseous argon to cool the optical fiber, in the production process.
SOLUTION: Gaseous helium charged into a drawing furnace of a device through a gas charging port 3 placed below the drawing furnace 1 for a glass preform 5 is flown in the direction indicated by an arrow A and discharged from the drawing furnace 1 through a discharging port 4; connecting a cooling pipe 7 to the outlet side of an optical fiber 6, of the drawing furnace 1; charging gaseous argon into the device through another gas charging port 8 to cool the optical fiber 6 passing through the cooling pipe 7 and discharging the gaseous argon through another gas discharging port 10 placed at the lower end of the cooling pipe 7; and setting the temp. of the optical fiber 6 before introducing it into the gaseous argon to a value in the range of 800-1,300° C. Thus, the objective high strength single-mode optical fiber which shows a <0.2 dB/km transmission loss at a 1.55 . m wavelength (.), a delivery length greatly exceeding 30 km per single optical fiber at a 2% (elongation) proof load, lesser variation in outer diameter and low loss, can be produced.



LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] The manufacture method of the optical fiber which supplies gaseous helium in the aforementioned wire-drawing furnace, carries out wire drawing of the aforementioned glass base material, and is characterized by introducing the aforementioned optical fiber by which wire drawing was carried out into argon gas, and cooling in the manufacture method of the optical fiber which carries out wire drawing of the glass base material in a wire-drawing furnace, and manufactures an optical fiber.

[Claim 2] It is the manufacture method of the optical fiber given in the 1st term of a claim characterized by for introduction into the aforementioned argon gas of the aforementioned optical fiber setting the temperature of the aforementioned optical fiber as 800-1300 degrees C, and performing it.
[Claim 3] It is the manufacturing installation of the optical fiber characterized by to have the cooling path which it consists of cooling pipes which introduce the optical fiber sent out from the wire-drawing furnace which carries out wire drawing of the glass base material, and the aforementioned wire-drawing furnace, and cool inside, the aforementioned wire-drawing furnace is equipped [path] with the gas input port which supplies gaseous helium to the interior, and the gas exhaust port which discharges gaseous helium outside, and the aforementioned cooling pipe is connected [path] to the outlet side of the optical fiber of the aforementioned wire-drawing furnace, and circulates argon gas

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] About the manufacture method of an optical fiber, and a manufacturing installation, especially this inventions are high intensity and low loss, and relate to the manufacture method for manufacturing an optical fiber with little outer-diameter change, and a manufacturing installation.
[0002]
[Description of the Prior Art] Argon gas or gaseous helium is passed for the dust eccrisis which generally generates an optical fiber in antioxidizing of a heat insulator, and a wire-drawing furnace in the wire-drawing furnace for carrying out melt spinning, and these gas is widely used for the basis of the advantage which is expressed below in this field.
[0003] Since argon gas has the property to anneal an optical fiber on the basis of characteristic low thermal conductivity, it has the advantage which suppresses the transmission loss of an optical fiber low. on the other hand, the exclusion efficiency of the generation dust which causes an on-the-strength fall of an optical fiber since this high coefficient of kinematic viscosity is enabled at a pan to raise the rate of flow of the gas in a wire-drawing furnace can be raised by gaseous helium having the outer-diameter change prevention effect of the prevention of a turbulent flow by the high gas coefficient of kinematic viscosity, and the optical fiber by it, therefore manufacture of the optical fiber of high intensity is enabled
[0004]
[Problem(s) to be Solved by the Invention] However, according to the conventional manufacture method which uses argon gas, since the coefficient of kinematic viscosity of argon gas is low, it is easy to generate a turbulent flow in a wire-drawing furnace, and, for this reason, there is a difficulty that outer-diameter change of an optical fiber becomes large.
[0005] Moreover, when using argon gas, since dust exclusion efficiency cannot be raised for this reason, prevention of on-the-strength degradation of the optical fiber which considered generation dust as the cause is difficult [it is difficult to set up the rate of flow of gas highly for a low coefficient of kinematic viscosity, and].
[0006] On the other hand, in using gaseous helium, since the thermal conductivity of gaseous helium is high, cooling to an optical fiber comes to pass quickly, and for this reason, the transmission loss of an optical fiber is made to increase and it makes manufacture of the optical fiber of low loss difficult. It is usually that the transmission loss when using gaseous helium becomes high [km] about 0.005-0.02dB /compared with the time of using argon gas.
[0007] Therefore, the purpose of this invention suppresses outer-diameter change, prevents the on-the-strength fall by generation dust, and is to offer further the manufacture method of the optical fiber which prevented increase of transmission loss, and a manufacturing installation.
[0008]
[Means for Solving the Problem] The manufacture method of the optical fiber characterized by for this

invention supplying gaseous helium in the aforementioned wire-drawing furnace in the manufacture method of the optical fiber which carries out wire drawing of the glass base material in a wire-drawing furnace, and manufactures an optical fiber in order to attain the above-mentioned purpose, carrying out wire drawing of the aforementioned gas base material, introducing the aforementioned optical fiber by which wire drawing was carried out into argon gas, and cooling is offered.
[0009] Moreover, the wire-drawing furnace which carries out wire drawing of the glass base material inside in order that this invention may attain the above-mentioned purpose, It consists of cooling pipes which introduce the optical fiber sent out and are cooled from the aforementioned wire-drawing furnace. the aforementioned wire-drawing furnace It has the gas input port which supplies gaseous helium to the interior, and the gas exhaust port which discharges gaseous helium outside. the aforementioned cooling pipe It connects with the outlet side of the optical fiber of the aforementioned wire-drawing furnace, and the manufacturing installation of the optical fiber characterized by having the cooling path which circulates argon gas is offered.
[0010] According to the manufacture method of this invention, and the manufacturing installation, the 2% [of proof loads] shipment length per one articles of optical fibers enables offer of the optical fiber of a low loss and a high intensity single mode with little outer-diameter change to which the transmission loss in the wavelength of lambda= 1.55 micrometers exceeds 30km sharply in less than 0.2dB/km, for example.
[0011] In order to manufacture such a quality optical fiber, it is desirable to set up the temperature of the optical fiber introduced into argon gas within the limits of 800-1300 degrees C. If the temperature of an optical fiber becomes lower than 800 degrees C, since it becomes impossible to secure the glass viscosity of 1014.5P or less required for internal distorted removal, it will be hard coming to obtain the effect of transmission loss suppression based on annealing by argon gas.
[0012] Moreover, if the temperature of the fiber at the time of going into argon gas comes to exceed 1300 degrees C conversely, since the viscosity of a fiber will arrive at the 1011-12P field which is the distortion start viscosity by structure-of-glass relief, outer-diameter change which considered this as the cause comes to arise, and it is not desirable.
[0013]
[Embodiments of the Invention] Next, the manufacture method of an optical fiber and the form of operation of a manufacturing installation by this invention are explained. In drawing 1 , 1 shows the gas input port in which a wire-drawing furnace and 2 were prepared in the heater of the wire-drawing furnace 1, and 3 was prepared down the wire-drawing furnace 1, and gaseous helium is supplied from here. The supplied gaseous helium is passed in the direction of Arrow A in the inside of the wire-drawing furnace 1, and is discharged from the gas exhaust port 4.
[0014] The glass base material with which wire drawing of 5 is carried out in the wire-drawing furnace 1 at which gaseous helium flows, and 6 show the optical fiber by which wire drawing was carried out. The cooling pipe with a length of 3m by which 7 was connected to the outlet side of the optical fiber 6 of the wire-drawing furnace 1, and 8 show the gas input port prepared in the upper part, and the argon gas supplied from here flows the inside of the cooling path 9 in the direction of Arrow B, and is discharged from the gas exhaust port 10 of the soffit of a cooling pipe 7.
[0015] Hereafter, the example based on the composition of drawing 1 , the example of reference, and the conventional example are explained.
[Example] While supplying gaseous helium by 30l. flow rate for /in the wire-drawing furnace 1, argon gas was supplied by 5l. flow rate for /into the cooling pipe 7, conditions were set up so that the temperature of the optical fiber 6 included in a cooling pipe 7 might become 1000 degrees C further, and the predetermined optical fiber was manufactured by performing wire-drawing spinning from the glass base material 5 under this state.
[0016]
[The example 1 of reference] In the example, the predetermined optical fiber was manufactured by setting the temperature of the optical fiber 6 when going into a cooling pipe 7 as 700 degrees C, and setting others as the same conditions.

[0017]
[The example 2 of reference] In the example, the predetermined optical fiber was manufactured by setting the temperature of the optical fiber 6 when going into a cooling pipe 7 as 1400 degrees C, and setting others as the same conditions.
[0018]
[Conventional example] In the example, the predetermined optical fiber was manufactured by removing a cooling pipe 7, losing supply of argon gas, and setting the temperature of the optical fiber 6 when coming out of the wire-drawing furnace 1 as 900 degrees C further.
[0019] The characteristic test result of the optical fiber obtained by the above example, example of reference, and conventional example is shown in Table 1.
[0020]
[Table 1]

—	損失(dB／km)		プルーフ通過長	外径変動幅
	λ=1.3μm	λ=1.55μm	(km、σ=2%)	(μm)
実施例	0.330	0.192	39.6	±0.3
参考例1	0.347	0.210	36.5	±0.3
参考例2	0.332	0.192	38.3	±0.7
従来例	0.352	0.213	34.9	±0.3

[0021] According to Table 1, the optical fiber by the example clears km in less than 0.2dB /at low loss, at for example, the time of lambda= 1.55 micrometers, about 40km long proof passage length is shown, further, in the case of the conventional example, compared with the small outer-diameter variation of **0.3 micrometers being shown, loss is more greatly [than an example] inferior, and a clear difference is accepted among both.
[0022] In addition, in the case of the example 1 of reference which set the temperature of the fiber 6 when going into a cooling pipe 7 as 700 degrees C and 1400 degrees C, and the example 2 of reference, the result of loss and outer-diameter change is not desirable. Therefore, in operation of this invention, you should consider about the temperature of the optical fiber when introducing into argon gas.
[0023]
[Effect of the Invention] As explained above, since wire drawing of an optical fiber is performed in gaseous helium with a high coefficient of kinematic viscosity according to the manufacture method of an optical fiber and manufacturing installation by this invention, efficient exclusion of the generation dust by the increase of a gas flow rate and prevention of the outer-diameter change by turbulent flow suppression can be aimed at, and since cooling of an optical fiber by which wire drawing was carried out is performed in argon gas with annealing nature, the increase in transmission loss can be suppressed further.
[0024] Therefore, thereby, outer-diameter change is small and it becomes possible to offer an optical fiber with little loss with high intensity.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Explanatory drawing showing the manufacture method of an optical fiber and the gestalt of operation of a manufacturing installation by this invention.
[Description of Notations]
1 Wire-Drawing Furnace
2 Heater
3 Eight Gas injection section
4 Ten Gas eccrisis section
5 Glass Base Material
6 Optical Fiber
7 Cooling Pipe
9 Cooling Path

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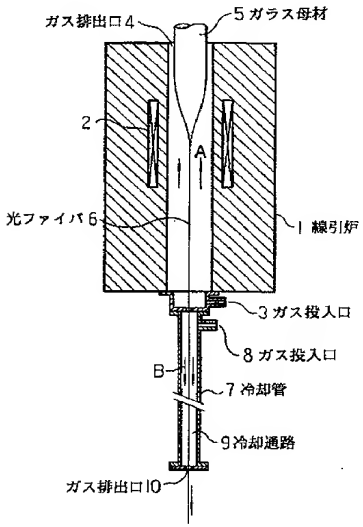
Drawing selection [Representative drawing]



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